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Some Aspects of the Pathogenesis of Bovine Tuberculosis, Based on Abattoir Returns*†

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In this communication an analysis of abattoir returns of tuberculous cattle will be made and discussed in the light of personal experience, especially in relation to the common sites of entry of the tubercle bacillus. The dissemination of the disease, after primary infection, will also be discussed.

It has never been seriously debated that the primary site of infection is intestinal when the only lesions present in the body are in the mesenteric lymph glands, whether alone or in combination with intestinal lesions. The significance of tuberculous bronchial and mediastinal lymph glands, in the absence of intestinal or mesenteric lymph gland lesions, has, however, been much debated. Villemin (1868) first suggested that these lesions originated by inhalation of tubercle bacilli, and he was later supported in this view by Koch (1901). Von Behring (1903) formulated the theory that the portal of entry in such cases was by the alimentary tract and that the bacilli having entered the body by this route passed through the mucous membrane of the intestine and also through the related lymph glands, without producing in them any lesions. Such bacilli were supposed either to pass to the lungs by the thoracic duct and the right heart, or to pass to the mediastinal and bronchial glands by direct lymphogenous channels and here produce their first lesions. Calmette and Guerin (1905 and 1906) strongly supported this view and reported many animal experiments to support their contentions. These inconclusive experimental findings have been strongly criticised; M'Fadyean (1910) believed that their evidence tended, if anything, to show that lung and lung gland lesions do not occur after ingestion experiments without previous lesions in the mesenteric glands. Many subsequent experiments have been performed but none has afforded absolute evidence for either theory. It has been conclusively shown that larger numbers of tubercle bacilli are needed to infect an animal by the alimentary than by the respiratory tract. The problem has been approached in other ways, such as by morbid anatomical study of naturally occurring tuberculosis, mostly in the human subject, but this also has failed to provide incontrovertible evidence. Nevertheless, much valuable work has been done, most of which suggests that the thoracic lymph glands are infected directly from inhalation lesions of the lung. One of the main methods of morbid anatomical approach has been to demonstrate in the lung primary aerogenous lesions to account for the involvement of the bronchial glands. Parrot (1876) was the first to describe these primary lung lesions and, as a result of extensive and thorough work, he stated that the tracheo-bronchial gland lesions could be trusted to indicate the presence of lung lesions. Since Parrot numerous workers have made similar careful morbid anatomical studies, and it is now generally accepted that, in man, if caseation is present in the bronchial glands, then the lungs are the portal of entry. More recently Blacklock (1932) attacking the problem in a different way, has given further very strong evidence in support of this view: he found that many primary alimentary lesions in children are caused by the bovine type of bacillus, while primary lung and lung gland lesions are chiefly caused by the human type of bacillus. This is to be expected, if bronchial and tracheal lymph gland caseation is due to inhalation infection, since this route of infection is most likely to arise during contact with cases of open pulmonary tuberculosis which in the human being are predominantly caused by the human type of bacillus. On the other hand, mesenteric lymph gland lesions arise from ingestion of tubercle bacilli, milk infected with the bovine type of bacillus often being the source of infection.

Material for extensive morbid anatomical work on bovine tuberculosis is very plentiful, and since animals are killed for food at all stages of the disease process, it has not been so difficult as in the human to trace the pathogenesis of the various bovine lesions. While it is not intended to discuss here the extensive morbid anatomical data accumulated, it can be stated that when only bronchial and mediastinal glands are affected, or when lesions in these glands are the oldest lymph gland lesions in the body, then contemporaneous lesions will usually be found in the lungs. In this communication such lymph gland lesions will be taken as an indication of primary respiratory infection.

Veterinary literature is almost entirely lacking in carefully recorded *post-mortem* findings of large numbers of tuberculous cattle and little use has been made of the existing recorded abattoir findings, so that the common portals of entry of the tubercle bacillus into the bovine body have not been well assessed. A survey of veterinary literature shows that it was fairly well appreciated by observers at the end of the last century that in cows pulmonary and bronchial/mediastinal lymph gland tuberculosis was the most frequent form of tuberculosis. Since that time, and especially since Behring's hypothesis, supported strongly by Calmette, was put forward, it has become a widely held opinion that the common site of infection in cattle is the intestine (Edwards, 1937; Calmette, 1923; Mettam, 1906; Cadeac, 1909; Muller, 1906; Vallee, 1905; Innes, 1937; Udall, 1939; Edit., 1908; Edit., 1910). The majority of the more recent writers on this question, however, give no evidence to support their conclusions, so that the reader is at a loss to know on what grounds the writers base their opinions. In consequence, it is not surprising that so much confusion exists as to the frequency of the various sites of tuberculosis in cattle.

It was therefore considered that an analysis of the meat inspection returns of two large abattoirs (Edinburgh and Birmingham) might give useful evidence as to the common sites of infection in cattle. At both of these abattoirs meat inspection is carried out under strict veterinary control and it is certain that lesions of macroscopic size in the lymph glands of the head and lung are seen and recorded. Personal observation has shown that characteristic tuberculous lesions of the retropharyngeal, bronchial and mediastinal lymph glands are rarely missed. Mesenteric gland lesions are more frequently overlooked but it is considered that the percentage missed is not great.

Tables of incidence, etc., for heifers, bullocks, cows and bulls, have been compiled from the detention records of the two abattoirs; but since, on the whole, they agree closely, only one set of figures will be given, and where differences do occur these will be given in the text. In the case of heifers, bullocks and cows, the returns of 3,000 consecutive tuberculous animals were examined but in the case of bulls it was only possible to obtain figures for 1,000 animals. The returns for tuberculous calves, aged from a few days to several months, were compiled from the records of the Chief Veterinary Officer of Edinburgh (Mr. Gofton).

Many important deductions, including the incidence of tuberculosis in each group, can be stated from examination of the results (see Tables I to IV) and it is interesting to note that the incidence in the same group varied little from year to year over a long period. The data obtained from the detention records were analysed and grouped so that lesions clearly indicating a definite portal of entry of the disease were classified together under each age group (calves, heifers, bullocks, cows and bulls) and compared one with the other. In this classification, retropharyngeal gland lesions are taken as arising from pharyngeal infection, which may indicate ingestion or inhalation; bronchial and mediastinal lymph gland lesions are taken as indicating lung infection by inhalation; mesenteric gland lesions are taken as indicating infection by ingestion. In addition to these uncomplicated portals of entry, various groups of lesions are also associated, so that such combinations of lesions as head and lung, head and intestine, lung and intestine, etc., are grouped together. In this way, one can determine which lesions are frequently associated together and from this some idea of the pathogenesis of the disease can be gained.

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TABLE I

Edinburgh	Calves. Incidence 1·89% (189 Tuberculous Animals)		
Organ Complex	No.	% T.B.	% of Total
Head	4	2	0·04
Lungs and lung glands	98	51	0·98
Head and lungs	1	—	—
Intestine	1	—	—
Intestine and head	1	—	—
Intestine, liver and head	—	—	—
Intestine and lungs	6	2·6	0·06
Head, intestine and lungs	2	1	0·02
Lungs and liver	39	20	0·39
Head, lungs and liver	—	—	—
Lungs, liver and intestine	17	8·9	0·17
Head, lungs, intestine and liver	5	2·5	0·05
Liver	15	8	0·15

CALVES

The incidence of tuberculosis in calves up to three to four months old is low, only 189 out of 10,000 calves being tuberculous, an incidence of 1·89 per cent. Mesenteric lymph gland lesions occur in only 32 cases out of 189, that is in 15·0 per cent. of tuberculous calves or 0·3 per cent. of all calves. Of these, 22 also show portal lymph gland lesions, which gives support to the contention that these glands may be infected from the duodenum during primary infection (White and Minett, 1941). Lesions confined to the thorax occur in 51 per cent. of tuberculous calves, or 0·98 per cent. of all calves. Only 2 per cent. of tuberculous calves, or 0·04 per cent. of all calves, show lesions confined to the retropharyngeal lymph glands. The remaining 28 per cent. of tuberculous calves show lesions confined to the liver or liver and lung glands ; this probably indicates that congenital infection occurs in 0·5 per cent. of all calves.

TABLE II

Edinburgh	Heifers. Incidence 6·2% (3,000 Tuberculous Animals)		
Organ Complex	No.	% T.B.	% of Total
Head	615	20·4	1·3
Lungs and lung glands	657	22·0	1·4
Head and lungs	246	8·2	0·5
Intestine	159	5·3	0·3
Intestine and head	66	2·2	0·1
Intestine, liver and head	32	1·0	0·1
Intestine and lungs	120	4·0	0·2
Head, intestine and lungs	150	5·0	0·3
Lungs and liver	401	13·4	0·8
Head, lungs and liver	57	1·9	0·1
Lungs, liver and intestine	201	6·7	0·4
Head, lungs, intestine and liver	234	7·8	0·5
Liver	69	2·3	0·1

TABLE III

Edinburgh	Bullocks. Incidence 5·7% (3,000 Tuberculous Animals)		
Organ Complex	No.	% T.B.	% of Total
Head	1,008	33·6	1·9
Lungs and lung glands	789	26·3	1·5
Head and lungs	218	7·2	0·4
Intestine	160	5·3	0·3
Intestine and head	32	1·0	0·1
Intestine, liver and head	54	1·7	0·1
Intestine and lungs	80	2·7	0·2
Head, intestine and lungs	48	1·6	0·1
Lungs and liver	180	6·0	0·3
Head, lungs and liver	60	2·0	0·1
Lungs, liver and intestine	172	5·7	0·3
Head, lungs, intestine and liver	100	3·3	0·2
Liver	125	4·1	0·2

HEIFERS AND BULLOCKS

Analysis of the meat inspection returns shows that in the two groups, the incidence of the disease and the organ complexes affected are similar, suggesting that the pathogenesis of the disease in heifers and bullocks is the same. The incidence of tuberculosis in the two groups varies slightly over a period of years but averages at 6 per cent. In heifers and bullocks primary intestinal infection is relatively low, since lesions confined to the mesenteric lymph glands occur in only 5·3 per cent. of tuberculous animals or 0·3 per cent. of all animals of the group, while not more than 32 per cent. of such tuberculous animals or 1·9 per cent. of all heifers and bullocks have mesenteric lymph gland lesions, even in conjunction with lesions in other situations.

The incidence of primary respiratory infection in the heifer and bullock, as indicated by lesions confined to the thoracic glands, differs in the two abattoirs. At Birmingham the incidence is 35 per cent. of tuberculous animals or 2·1 per cent. of all animals, while at Edinburgh (as indicated in the table), the incidence is 22 and 26·3 per cent., and 1·4 and 1·5 per cent. respectively. Primary pharyngeal infection, as indicated by lesions confined to retropharyngeal lymph glands, also varies as regards incidence at the two abattoirs. At Birmingham 18 per cent. of tuberculous animals or 1·0 per cent. of all animals have such lesions ; while at Edinburgh, as indicated in the table, pharyngeal infection occurs in 33·6 per cent. of tuberculous bullocks and 20·4 per cent. of tuberculous heifers, that is in 1·9 per cent. and 1·3 per cent. respectively of all animals. In addition, 7·2 to 8·2 per cent. of tuberculous animals or 0·4 to 0·5 per cent. of all animals in these groups have lesions confined to the head and lungs. Lesions confined to hepatic lymph glands occur in 2·3 to 4·1 per cent. of tuberculous heifers and bullocks, or 0·1 to 0·2 per cent. of all animals ; while liver and lung lesions occur in 6 to 13·4 per cent. of tuberculous cases or 0·3 to 0·8 per cent. of all animals.

Simultaneous primary infections involving head, lungs, intestine and hepatic lymph gland, as well as secondary reinfection of these organs, make up the remaining 1·8 per cent. of all heifers and bullocks slaughtered. Abattoir returns are useless for assessing the significance of these multiple lesions.

TABLE IV

Edinburgh	Cows. Incidence 43% (3,000 Tuberculous Animals)		
Organ Complex	No.	% T.B.	% of Total
Head	277	9·2	4·0
Lungs and lung glands	1,103	36·8	15·8
Head and lungs	283	9·4	4·0
Intestine	110	3·7	1·6
Intestine and head	27	0·9	0·4
Intestine, liver and head	20	0·6	0·3
Intestine and lungs	384	12·8	5·5
Head, intestine and lungs	297	9·9	4·3
Lungs and liver	76	2·6	1·1
Head, lungs and liver	29	1·0	0·4
Lungs, liver and intestine	113	3·8	1·6
Head, lungs, intestine and liver	265	8·8	3·8
Liver	16	0·5	0·2

Cows

The incidence of tuberculosis in adult dairy cows killed at the abattoir is very high ; in the period under investigation it was 43 per cent. and the incidence over a ten-year period shows little variation from this figure. Uncomplicated primary intestinal complexes account for only 3·7 per cent. of tuberculous cows or 1·6 per cent. of all cows. Intestinal lesions associated with pharyngeal lesions are also few, 0·9 per cent. of tuberculous cows or 0·4 per cent. of all cows killed having these lesions. Mesenteric gland lesions in association with pulmonary and pharyngeal tuberculosis are very common, 22·7 per cent. of tuberculous cows or 9·8 per cent. of all cows reaching the abattoir show such lesions. Uncomplicated pulmonary complexes occur in 36·8 per cent. of all tuberculous cows or in 15·8 per cent. of all abattoir cows. Associated pharyngeal and pulmonary tuberculosis occurs in 9·4 per cent. of tuberculous cattle, 4 per cent. of all cows. Uncomplicated pharyngeal infection occurs in 9·2 per cent. of tuberculous cows or 4 per cent. of all cows. Primary hepatic lesions occur in 0·5 per cent. of tuberculous cows or 0·2 per cent. of all cows killed. The remaining 17 per cent. of tuberculous cows show complex lesions which cannot be assessed from abattoir returns, that is 7 per cent. of all cows killed show such lesions.

TABLE V

Edinburgh	Bulls. Incidence 27% (1,000 Tuberculous Animals × 3)		
Organ Complex	No.	% T.B.	% of Total
Head	1,113	37	10
Lungs and lung glands	768	25·6	6·9
Head and lungs	312	10·4	2·8
Intestine	96	3·2	0·9
Intestine and head	33	1·1	0·3
Intestine, liver and head	30	1·0	0·3
Intestine and lungs	75	2·5	0·7
Head, intestine and lungs	78	2·6	0·7
Lungs and liver	120	4·0	1·1
Head, lungs and liver	60	2·0	0·5
Lungs, liver and intestine	141	4·7	1·3
Head, lungs, intestine and liver	135	4·5	1·2
Liver	33	1·1	0·3

Bulls

The incidence of tuberculosis in bulls, by the time these animals reach the abattoir, is 27 per cent.; this varies little from year to year. Uncomplicated intestinal tuberculosis in the bull occurs in 3·2 per cent. of tuberculous bulls or 0·9 per cent. of all bulls reaching the abattoir, while associated pharyngeal and intestinal tuberculosis occurs in 1·1 per cent. of tuberculous bulls or 0·3 per cent. of all bulls. Mesenteric gland lesions, in association with pulmonary or pulmonary and pharyngeal lesions, occur in 5·1 per cent. of tuberculous bulls or 1·4 per cent. of all bulls. Uncomplicated pulmonary tuberculosis occurs in 25·6 per cent. of tuberculous bulls or 6·9 per cent. of all bulls reaching the abattoir. Uncomplicated primary pharyngeal lesions occur in 37 per cent. of tuberculous bulls or 10 per cent. of all bulls. Primary hepatic lesions occur in 1·1 per cent. of tuberculous bulls or 0·3 per cent. of all bulls. Complex lesions occurring in lung, head, intestine and liver, occur in 16·2 per cent. of tuberculous bulls or 4 per cent. of all bulls.

DISCUSSION

In both sexes the incidence of tuberculosis is very low in calfhood; it rises to some extent in young cattle but it is not until the animal becomes mature that the incidence is so very high. The widely held belief that the common route of infection in the calf is by the intestine is not borne out by the morbid anatomical findings. The infrequency of the intestinal complex has also been shown by Schulz (1937). Thoracic gland tuberculosis is common in young calves, which suggests that infection is commonly by the respiratory tract. Hepatic lesions, either alone or in conjunction with thoracic lymph gland lesions, are also commonly found in young calves and these lesions are probably an indication of congenital infection. It can be seen from Table I that thoracic lymph gland lesions occur frequently in combination with hepatic lesions and also, but less frequently, in combination with mesenteric gland lesions; this, however, must not be taken to confirm Behring's hypothesis, since in the above instances lesions first occur in the abdominal cavity. It would appear from all the evidence that intestinal infection plays only a minor part in young calves and that congenital and pulmonary infections are the most important. It is essential, however, that further detailed morbid anatomical and experimental evidence should be brought forward for a proper understanding of calfhood tuberculosis.

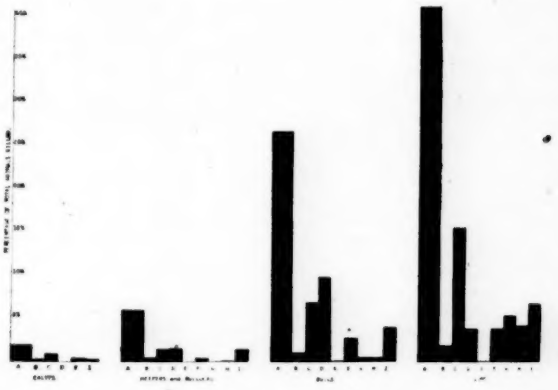
It could be argued that calves killed at the abattoir are too immature to be a representative sample since older calves are not usually killed, but if there is any marked difference in the route of infection in older calves, then this should be easily identifiable in the *post-mortem* records of tuberculous heifers and bullocks. Since the incidence of tuberculosis in heifers and bullocks is about 6 per cent. it is in fact evident that a proportion of bovines must become infected between early calfhood and young adult life, although the majority of these tuberculous animals have probably not been closely housed along with milking herds. The rise in incidence of the disease is due, in part, to an increase in retropharyngeal lymph gland lesions indicating that, in heifers and bullocks, the pharynx is a common site of entry of tubercle bacilli. This increase in incidence of retropharyngeal lymph gland tuberculosis is not, however, associated with any increase in the number of mesenteric lymph gland lesions. If then retropharyngeal lymph gland involvement is indicative of ingestion, as is by no means certain since these glands drain both respiratory and alimentary regions, then simultaneous involvement of the intestine or mesenteric lymph glands with concomitant lesions does not occur. Respiratory infection of the heifer and bullock, as indicated by the primary pulmonary complex, is also a common route of infection. In the bullock and heifer, with an increase in incidence of tuberculosis of approximately 4 per cent. over that in the calf, it is clear that about two-thirds of this increase is due to uncomplicated primary infections of pharynx and/or lung. Primary intestinal infection is infrequent.

The incidence of tuberculosis in the abattoir cow is very much higher than in the heifer and this is due in part to a very distinct rise in the incidence of uncomplicated pulmonary tuberculosis (*i.e.*, heifers 1·4 per cent. and cows 15·8 per cent. of all animals killed), while the incidence of pharyngeal tuberculosis is also higher. Primary intestinal infection plays no important part in the increased incidence of tuberculosis in the cow, although the cow, differing from the younger animal, frequently has mesenteric lymph gland lesions secondary to pulmonary tuberculosis; thus 40·4 per cent. of tuberculous cows, or 17·4 per cent. of all cows reaching the abattoir, have tuberculous mesenteric lymph nodes. Personal observation at a large number of *post-mortem* examinations of tuberculous cows has convinced us that the majority of mesenteric gland lesions are not due to primary intestinal infection but are due to swallowing of tuberculous debris from progressive and open lung lesions. Hepatic lymph gland tuberculosis is also frequently observed along with these mesenteric gland lesions, which would appear to indicate that the hepatic lymph gland becomes infected from the intestinal tract. It has been repeatedly stated that in man late lesions of tuberculosis (third stage: Ranke, 1928), in contrast to primary lesions, are characterised by the absence of gross caseation of the regional lymph nodes. This certainly does not appear to apply to bovine tuberculosis and indeed recently Auerbach (1944) throws very definite doubt upon the veracity of this statement as applied to the human being. In the bovine comparatively gross caseation of pulmonary and mesenteric lymph nodes occurs frequently in other stages than in primary infection. To summarise, in the cow the predominant portal of entry would appear to be the lung, while associated with, and derived from, the lung lesions is the comparatively common multiple mesenteric gland tuberculosis.

The incidence of tuberculosis in the bull is lower than in the cow but is very appreciably higher than in bullocks or heifers. The common sites of entry are the pharynx and the lung, while intestinal complexes are infrequent. The bull differs from the cow in that extension of the disease from the lungs to the intestinal tract is not so frequent; so that mesenteric gland tuberculosis, a common feature of the older cow, is not seen so frequently in the bull.

In all groups, the incidence of lesions confined to the hepatic lymph gland is relatively constant (0·1 to 0·3 per cent. of animals killed) and, since congenital tuberculosis is not necessarily lethal to the calf, it is possible that these isolated hepatic lymph gland cases of older animals are in fact cases of surviving congenitally infected animals. Such cases recognised on *post-mortem* examination have been described by Gofton (1937) and McKay (1943).

The accompanying graph shows the relative incidence of tuberculosis in the various age groups, along with the frequency of the various organ complexes.



A = Incidence of tuberculosis.
B = " primary intestinal lesions.
C = " " lung lesions.
D = " " pharyngeal lesions.
E = " " liver lesions.
F = " lesions confined to pharynx and lung.
G = " " " lung and intestine.
H = " " " pharynx, lung and intestine.
I = " complex lesions associated with pulmonary tuberculosis.

Dissemination of Tubercle Bacilli after Primary Infection

It has for long been thought that tubercle bacilli only disseminate along preformed lymphatic channels and the explanation for the situation of naturally occurring lesions has depended entirely upon the presence of known and unknown lymphatic pathways, spread being in no way embarrassed by the direction of the lymph flow, even in perfectly healthy regions. An accurate knowledge of the dissemination of bovine tuberculosis is essential for those who in the capacity of meat inspectors have to judge the carcases of slaughtered tuberculous animals. The idea that lymphatic extension is the only important method of dissemination in the bovine is dangerous. A focus of tuberculosis, once established at a primary site of entry, may progress by direct infiltration of surrounding tissues and this is seen frequently around the primary lung lesions of the bovine.

Dissemination may also occur by lymphatic channels and examples of this are numerous, *e.g.*, the initial lung focus reaching the related hilar glands, intestinal infection reaching mesenteric and hepatic glands and progressing from these to the caudal mediastinal and other thoracic glands, etc. Tuberculous lung lesions in the bovine may disseminate extensively by the bronchial passages to give the characteristic and very frequently occurring bronchopneumonic lung lesions from which infection passes to the trachea, pharynx and intestine, and thence to the peritoneum. Dissemination by natural passages, other than bronchi, also occurs; for example, infection may pass from peritoneum to uterus, by the Fallopian tube; from kidney to bladder by the ureters, and throughout the udder by the milk ducts. In all these examples, however, the dissemination is "local" and must be clearly distinguished from "generalisation" of the disease, which term should be confined to haematogenous tuberculous dissemination. In the bovine, this haematogenous dissemination has not received adequate recognition. It must be clearly understood that haematogenous dissemination includes all cases where tubercle bacilli are carried by the general blood circulation. Sometimes the lesions which occur in haematogenous dissemination are few in number and benign in type, while, on the other hand, haematogenous dissemination may cause widespread miliary tuberculosis with severe illness. All stages between discrete and isolated nodules and acute miliary tuberculosis may be seen.

The method by which tubercle bacilli reach the blood stream is controversial and probably varies in different cases. A discussion on haematogenous tuberculous dissemination must, however, begin with the bacteriaemia which is almost invariable in primary infection (Kayne, Pagel and O'Shaughnessy, 1939). As Rich and McCordock (1929) state, "There is no reason why tubercle bacilli should not enter the small vessels of the area of inflammation just as other bacteria do and thus quickly give rise to a possibly transient bacteriaemia. No one doubts this in pyogenic lesions, why should it be doubted in a tuberculous lesion? The tubercle bacillus has come for no sensible reason to be regarded as different from all other organisms in that it is popularly supposed that it does not infect the blood stream in the usual manner." Experimentally in many animals bacteriaemias are often present soon after primary infection and during the formation of the primary complex. It has been shown that similar bacteriaemias also occur during any progressive and active post-primary lesion. Other methods by which tubercle bacilli may reach the blood stream in the human have been described by Laennec (1879), Buhl (1874), Hugnenin (1876), Weigert (1897), Auerbach (1944), etc.; for example, the erosion of veins by caseous masses, or the erosion of "Weigert" tubercles situated in the intima of veins. A further common method of haematogenous dissemination in both the human and bovine disease is that tubercle bacilli reach the general circulation by the lymphovenous route.

A survey of abattoir figures, with special reference to haematogenous dissemination of lesions in the bovine, has been carried out, since it is considered that meat inspection methods, at some centres, have overlooked the possibility of this type of dissemination. At many abattoirs lesions confined to lungs, head or gut, are not taken as necessitating general carcase examination. The Public Health (Meat) Regulations (Scotland) 1932, the only statutory rules for meat inspection in Great Britain, also appear to minimise the importance of this method of spread, in that if lesions are confined, on first examination, to the organ of entrance, *i.e.*, lung, head or intestine, then only the regional glands must be examined, so inferring that lymphogenous spread alone is of importance. It must be admitted, however, that even these Regulations are frequently not followed and in consequence examination of carcase lymph glands is minimal at many centres.

Abattoir records were available for examination from two large abattoirs in this country, one (Birmingham) carrying out comprehensive carcase lymph gland examination in nearly all cases of tuberculosis, the other (Edinburgh) doing so when lesions are present on the pleura and/or peritoneum or in the liver and/or hepatic lymph gland. It was considered that these might give an indication of the frequency of haematogenous dissemination and, at the same time, by comparing the two one might indicate the frequency with which carcase lymph gland lesions are overlooked in the less complete systems of meat inspection. In addition, if the results were so tabulated that the portals of entry were also indicated, it would be possible to determine from which organs dissemination most frequently occurs. For this purpose, only those carcase lymph gland lesions which obviously did not arise by direct lymphatic drainage from a primary site of entry, were taken as a true indication of haematogenous dissemination, *i.e.*, lesions in popliteal, prescapular, precrural and inguinal lymph glands; in addition, lesions of bone and central nervous system were also taken as an indication. It is known that kidney, udder, uterus, etc., undoubtedly can be infected from the blood stream, but since the route of infection of such organs is not constant, lesions in these organs could not be used as evidence of blood spread. No true assessment of the frequency of haematogenous dissemination to lymph glands can be made from the records of advanced pleural and peritoneal cases of tuberculosis since at neither abattoir is carcase lymph gland examination carried out in these cases, as the carcase is totally condemned without further examination. The numbers of cases in which haematogenous dissemination can be definitely said to have occurred are therefore minimal.

Table VI shows the frequency of haematogenous dissemination as indicated by involvement of peripheral carcase lymph glands along with the relative frequency of this type of dissemination from the various portals of entry of the disease. This can obviously only be assessed from the returns of the Birmingham abattoir where complete carcase examination is carried out in the majority of cases of tuberculosis. (The returns of this abattoir are given second under each heading in Table VI and should be compared with the first figures which are obtained from the returns of the Edinburgh abattoir where, as described above, carcase lymph gland examination is less complete.)

TABLE VI

Organ Complex	Calves				Heifers				Bullocks				Cows				Bulls			
	No. of T.B. cases	No. of haem.	% haem. of T.B. Animals	% haem. of total	No. of T.B. cases	No. of haem.	% haem. of T.B. Animals	% haem. of total	No. of T.B. cases	No. of haem.	% haem. of T.B. Animals	% haem. of total	No. of T.B. cases	No. of haem.	% haem. of T.B. Animals	% haem. of total	No. of T.B. cases	No. of haem.	% haem. of T.B. Animals	% haem. of total
Head	4	Nil	Nil	Nil	615	Nil	Nil	Nil	1,008	Nil	Nil	Nil	277	Nil	Nil	Nil	1,113	3	Neg.	0·1
					551	7	1·3	0·2	541	11	2	0·4	151	3	2	0·1	288	9	3	0·3
Lungs and lung glands	90	1	1·1	Neg.	657	3	0·5	0·1	789	1	Neg.	Nil	1,103	3	0·3	0·1	768	3	Neg.	0·1
					1,072	44	4·1	1·5	1,025	65	6·3	2·2	1,139	49	4·3	1·6	1,275	87	6·9	2·9
Head and lungs	1	Nil	Nil	Nil	246	3	1·2	0·1	218	1	Neg.	Neg.	283	1	Neg.	Neg.	312	3	1	0·1
					273	18	6·6	0·6	329	30	9	1·0	228	13	5·7	0·4	408	51	13	1·7
Intestine	1	Nil	Nil	Nil	159	Nil	Nil	Nil	160	Nil	Nil	Nil	110	Nil	Nil	Nil	96	Nil	Nil	Nil
					80	2	0·3	Neg.	78	1	1·3	Neg.	27	1	3·7	Neg.	27	Nil	Nil	Nil
Intestine and head	1	Nil	Nil	Nil	66	Nil	Nil	Nil	32	Nil	Nil	Nil	27	1	3·7	Neg.	33	Nil	Nil	Nil
					35	1	2·8	Neg.	57	1	1·8	Neg.	20	1	5	Neg.	33	3	9	0·1
Intestine, liver and head	0	Nil	Nil	Nil	32	6	18·8	0·2	54	Nil	Nil	Nil	29	Nil	Nil	Nil	30	Nil	Nil	Nil
					69	2	2·8	Neg.	63	Nil	Nil	Nil	16	1	6	Neg.	45	3	6	0·1
Intestine and lungs	5	2	40	0·02	120	3	2·5	0·1	80	1	1·2	Neg.	384	2	Neg.	Neg.	75	3	4	0·1
					104	3	2·9	0·1	99	4	4	0·1	160	6	4	0·2	198	9	4·5	0·3
Head, intestine and lungs	2	Nil	Nil	Nil	150	9	6·0	0·3	48	2	4	Neg.	297	5	1·7	0·2	78	3	4	0·1
					42	1	2·4	Neg.	69	Nil	Nil	Nil	83	5	6·0	0·2	111	3	2·8	0·1
Lungs and liver	39	21	53	0·2	401	21	5·2	0·7	180	14	8	0·5	76	1	1·3	Neg.	120	3	2·5	0·1
					194	11	5·6	0·4	207	19	9·1	0·6	222	7	3·1	0·2	132	18	13·6	0·6
Head, lungs and liver	8	7	87	0·07	57	15	26·3	0·5	60	14	23·3	0·5	29	1	3·5	Neg.	60	9	15·0	0·3
					91	7	7·8	0·2	85	11	13·7	0·2	171	13	8·0	0·4	72	12	16·6	0·4
Lungs, liver and intestine	17	10	59	0·1	201	24	12·0	0·8	172	21	12	0·7	113	2	1·8	Neg.	141	18	12	0·6
					215	30	14·0	1·0	213	25	11·7	0·8	252	16	6·4	0·5	141	9	6	0·3
Head, lungs, intestine and liver	5	5	100	0·05	234	42	18·0	1·4	100	17	17	0·6	265	21	8	0·7	135	12	9	0·4
					248	31	13·0	1·0	206	49	24	1·6	463	40	8·7	1·3	261	39	15	1·3
Liver	15	Nil	Nil	Nil	60	Nil	Nil	Nil	99	Nil	Nil	Nil	16	Nil	Nil	Nil	38	Nil	Nil	Nil
Liver and head	Nil	Nil	Nil	Nil	9	Nil	Nil	Nil	26	Nil	Nil	Nil	5	Nil	Nil	Nil	Nil	Nil	Nil	Nil

In each case the percentage of tuberculous animals showing haematogenous dissemination is followed by the percentage of all animals killed showing such lesions. In the case of the calves, only one set of figures is given, since carcase lymph gland examination at both abattoirs is complete. It is evident from Table VI that carcases with tuberculous carcase lymph glands must be passed as fit for food when examined at abattoirs where meat inspection methods are incomplete, while similar cases would be detained at abattoirs where examination is complete. Uncomplicated retropharyngeal and mesenteric lymph gland lesions, in all groups, are only occasionally associated with lesions in carcase lymph glands but lung and lung gland lesions with, or without, concomitant retropharyngeal lesions, quite frequently show this association. Thus when examination is complete 4·1 per cent. of heifers, 6·3 per cent. of bullocks, 4·2 per cent. of cows and 6·9 per cent. of bulls with lung gland involvement show lesions also in carcase lymph glands, while if examination is incomplete the percentage of such cases is negligible. Similarly, 6·6 per cent. of heifers, 9 per cent. of bullocks, 5·7 per cent. of cows and 13 per cent. of bulls, with head and lung lymph gland lesions have lesions also in carcase lymph glands which are not detected on incomplete examination. In the numerous cases where both lung and liver are involved, carcase lymph gland lesions are frequent, but since the liver is involved carcase lymph gland examination is complete under both systems of meat inspection. From the above it appears quite evident that tuberculous lesions of the lung and its regional lymph glands are of great significance in meat inspection, since these lesions are frequently associated with haematogenous dissemination. In addition it is known that lung lesions are also frequently associated with lesions in the regional carcase lymph glands by direct lymphatic drainage from the lung with or without concomitant lesions on the pleura ; a further reason why carcase lymph glands should be examined when lung lesions are present.

General Conclusions

An analysis of extensive abattoir returns of tuberculous cattle has been made and for this purpose the route of infection is taken as being indicated by the presence of a primary complex. From the figures obtained and from personal observation, it is suggested that the pathogenesis of tuberculosis in cattle may be as follows.

In calves the incidence of the disease is very low, infection arising chiefly in two ways, congenitally or by inhalation after birth. Haematogenous dissemination is frequently encountered in the calf following primary infection. The incidence figures for heifers, bullocks, bulls and cows show, with certainty, that tuberculosis of the adult is not merely a slow progression of lesions acquired in calfhood. It is obvious that the incidence increases quickly after the animal has attained maturity, so that while in heifers and bullocks the incidence is 6 per cent., in bulls it is 27 per cent. and in cows 43 per cent. In the older animals the figures are obviously not representative of the cows and bulls on our farms, where undoubtedly the incidence is lower, but it is clear that 43 per cent. of our cows do become infected during their lifetime. In these cases the primary complex is predominatingly pulmonary in position. Post-primary haematogenous dissemination giving rise to carcase lymph gland lesions also occurs in these older animals, although not so frequently as in the calf. The common method of dissemination of tuberculosis in these older animals is by the bronchial passages while further dissemination from the lungs occurs by coughing up and swallowing of tuberculous debris, giving rise to caseous lymphadenitis of the mesenteric lymph glands. In addition to these primary lung infections there are also in the adult bovine a considerable number of cases where lymph gland changes are only seen in the retropharyngeal lymph glands. These glands drain both respiratory and alimentary areas so that it is uncertain by which of these routes infection enters, although the fact that retropharyngeal gland lesions are much more frequently associated with lung and lung gland lesions than with mesenteric gland lesions might indicate that the majority of these lesions are due to inhalation infection.

Tuberculosis of the liver and/or hepatic lymph glands are also frequently occurring lesions but the route of infection is complex : (1) Directly from the umbilical vein in congenital tuberculosis ; (2) From primary intestinal tuberculosis ; (3) From early or late post-primary haematogenous dissemination ; (4) From secondary infection of the bowel from swallowed tuberculous sputum. This variety of routes of involvement of the liver and hepatic glands makes these lesions unreliable for the evaluation of the pathogenesis of bovine tuberculosis.

Summary

(1) The theories regarding the portals of entry of the tubercle bacillus in bovine tuberculosis are reviewed.

(2) The abattoir returns for 189 tuberculous calves, 3,000 tuberculous heifers, 3,000 tuberculous bullocks, 1,000 tuberculous bulls and 3,000 tuberculous cows are analysed and discussed.

(3) The dissemination of the disease in the bovine body is described, the importance of haematogenous dissemination being shown.

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We also wish to express our thanks to the City of Edinburgh abattoir staff.

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MINISTRY OF AGRICULTURE NEWS SERVICE

Productive Type in Poultry.—This season's National Laying Test provides an educational feature of considerable value in a section called Type and Production, which was intended originally to check the tendency to ignore breed characters in production stock. This is the third season for this section, and proof of its popularity is seen in a very large entry, necessitating balloting out of many pens. Nevertheless, 80 pens of all breeds are competing, including Rhode Island Reds, Light Sussex, White Wyandottes, Buff Rocks, White and Black Leghorns and Anconas. The birds are judged and awarded points for type and physical character at entry, and again at the close of the test. These points are added to the egg scores, awarded for first and special grade eggs, of a character suitable for hatching.

Since there is much variation in productive type among Rhode Island Reds this breed has attracted most attention. Recently a party of Ministry officials and area and county poultry advisers spent a profitable day studying breed type in relation to production. It may be many years before it can be decided which is the best type for production (even if there is a best), but in the meantime this demonstration test is helping the poultry industry to realise which types are not desirable.

. . . . . .

Care Needed in Feeding Sugar Beet Tops.—Not more than 42 lb. of sugar beet tops should be fed daily to cows in milk, otherwise their milk may develop a fishy taint. The tops should not be fed to the cows in the cowhouse, but on pasture immediately after the morning milking. Few farmers, however, rely entirely on beet tops for their cattle. They prefer to use the tops for the dry stock and kale and mangolds for the wet stock. This is a good practice. No taints in milk, however, should develop from small quantities of tops fed as recommended. Sugar beet tops have a fairly high sugar content and therefore produce thirst. See that cattle are supplied with plenty of fresh drinking water in a clean trough.

The French Veterinary Profession, Past and Present Organisation

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In 1901 the veterinary profession in France grouped itself for the first time into a representative association known as the "*Syndicat National des Vétérinaires*". This association, like the National Veterinary Medical Association, was voluntary in nature and comprised divisional (departmental), sectional and specialist groups. Its activities were intellectual and effectually presented the scientific background of the profession. It was instrumental in securing the post-graduate doctorate in veterinary medicine and in 1938 secured the passage of an Act forbidding the extension of unqualified practice, although by the provisions of this Act existing unqualified practitioners were allowed to continue during their lifetime.

By a decree dated June 16th, 1940, the Vichy Government enhanced the dignity of the profession by abolishing the Syndicat and constituting the Ordre des Vétérinaires, membership of which was compulsory for all diplomates. This was the first attempt at discipline within the profession. The Order had its central office in Paris and was represented there by a President, Vice-President, two Secretaries, Treasurer, seven Members of Council, a Supreme Disciplinary Court under the presidency of a State Councillor, and two legal advisers. (The Vichy Government at this time also created the Orders of all the learned professions, of which the Law had previously been the only profession so designated.)

After the liberation of France and the consequent overthrow of the Vichy Government the original Syndicat was automatically re-established, but the profession, realising the value of a disciplinary court, petitioned the Provisional Government to re-establish the Order.

Future Professional Organisation

Two bills at present under examination by the Government Departments interested envisage :—

1. The re-establishment of the *Syndicat National des Vétérinaires* and its divisions as they existed on June 16th, 1940.

2. The institution of a new *Ordre des Vétérinaires* of which the functions would be exclusively to exercise professional discipline.

The proposals submitted to the Provisional Government by the Supreme Council of the existing *Ordre des Vétérinaires* have been slightly modified by the departments concerned but the main body of recommendations remains unaltered, *viz.* :—

1. The Re-establishment of the Syndicat National des Vétérinaires

(*a*) The national syndicate, its departmental and regional divisions and sub-sections existing on June 16th, 1940, will be re-established with full rights and attributes.

(*b*) The funds of the present Order will be transferred to the syndicate and the property belonging to the divisions, etc., of the syndicate, together with their records, will be returned.

(*c*) Until such time as the councillors of the syndicate can be elected the following bodies will be instituted by a decree of the Minister of Agriculture :—

(*i*) *Provisional National Committee of Management*, of the national syndicate, consisting of a president and six members.

(*ii*) *Provisional National Committees of Management* for each of the divisions, etc., of the national syndicate, each composed of a president and four members.

2. Institution of a New Ordre des Vétérinaires

The new Order will be concerned exclusively with professional discipline and will be composed as follows :—

(*a*) *Regional Orders.*—One for each administrative district. All veterinary surgeons exercising their profession (but excepting full time Ministry inspectors) will be compulsorily enrolled on the Register of the Order. The members of council of each regional Order will be elected by vote within the division.

(*b*) *Council of the Order.*—This will be composed of six to eight members from each division, according to its voting strength. The Council will constitute itself the disciplinary committee on all subjects concerning the honour, morality and discipline of the profession. Its function will be to revise the Register of the Order, to reprimand professional shortcomings, and it will have the power to suspend members for periods up to but not exceeding ten years.

(*c*) *Supreme Council of the Order.*—This will consist of eight members elected by the divisional councils.

The functions of a supreme councillor will be incompatible with those of a divisional councillor. The Supreme Council will examine all State laws, ordinances and regulations affecting the profession. It will also act as the Supreme Disciplinary Court which will hear appeals against judgments given by the regional courts of discipline. The President of the Supreme Disciplinary Court will always be a Councillor of the Court of Cassation.

The following commissions will be immediately instituted in order to ensure the continuity of discipline within the profession :—

1. *Provisional National Committee of Management of the Supreme Council of the Order*, consisting of a president and six members named by decree.

2. *Provisional Regional Committees of Management* composed of a president and four members named by decree.

It is recommended that certain veterinary surgeons who have been affected by ordinances relative to collaboration with the enemy, who have been condemned to national indignity or who have been removed on grounds of integrity shall have no part in the direction of the above-mentioned professional bodies.

CLINICAL COMMUNICATION

Clinical Observations on an Experimental Case of Bovine Trichomoniasis

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Numerous records of clinical observations on cases of bovine trichomoniasis can be found in the literature, but few attempts have been made to give as complete an account as is possible of the various clinical observations that can be made on the course of the disease. Although all of the occurrences are subject to considerable individual variation, the particulars here recorded may serve as a useful example of the order of the appearance of the several clinical signs of trichomoniasis, and it is for this reason that the present data on an experimentally infected animal are published. Some observations are also recorded on diagnostic procedures that are still under investigation as they may be of value to other workers in this field of enquiry.

The experimental subject was a two-years-old Devon heifer which was artificially inseminated, and immediately afterwards was infected with a dose of 100 million organisms of the Belfast strain of *Trichomonas foetus*, in 3 c.c. of saline, both semen and trichomonads being placed in the cervical canal. At the 85th day* a foetus 11 cm. long was aborted with foetal membranes intact and on the 88th day the animal came into oestrum.

Observations were made on the following:—

(*a*) The appearance of the mucous membrane of the vagina and *cervix uteri* on inspection through a "Coldlite" vaginascope.

(*b*) The macroscopical and microscopical appearance of mucus samples collected by drawing them into the vaginascope by means of a long-handled spoon and examined under a magnification of 100 and 400 diameters ten to 15 minutes after collection.

(*c*) The number of active trichomonads per c.mm. of discharge, estimated by means of a Thoma Zeiss counting slide.

(*d*) The flow-elasticity of the vaginal mucus as measured by the oestroscope.

(*e*) The level of antibody response as shown by the agglutination and intradermal reactions of Kerr and Robertson, both being carried out at weekly intervals.

The details of these observations are set out in Figs. 1 and 2, by which means the synchronisation of the several occurrences seems to be best shown.

I. Observations on *T. foetus* in the Vaginal Discharge

The occurrence of trichomonads which were first observed 29 days after infection and the frequency with which they were subsequently demonstrated, is shown at C in Fig. 1.

Considerable variation was seen to occur in number, morphology, and in motility of trichomonads throughout the course of the observations. In general, a rise or fall in their numbers in the discharge was accompanied by a corresponding increase or reduction in their motility; at the outset of the period, 29th to the 50th day, organisms could easily be detected under the 2/3 inch objective, but towards the end of that time the motility was so reduced that there was little or no directional movement; all that could be discerned was the slight motion of the undulating membrane requiring a 1/6 inch objective for its detection. This

* The number of days mentioned throughout the paper refer to days subsequent to infection.

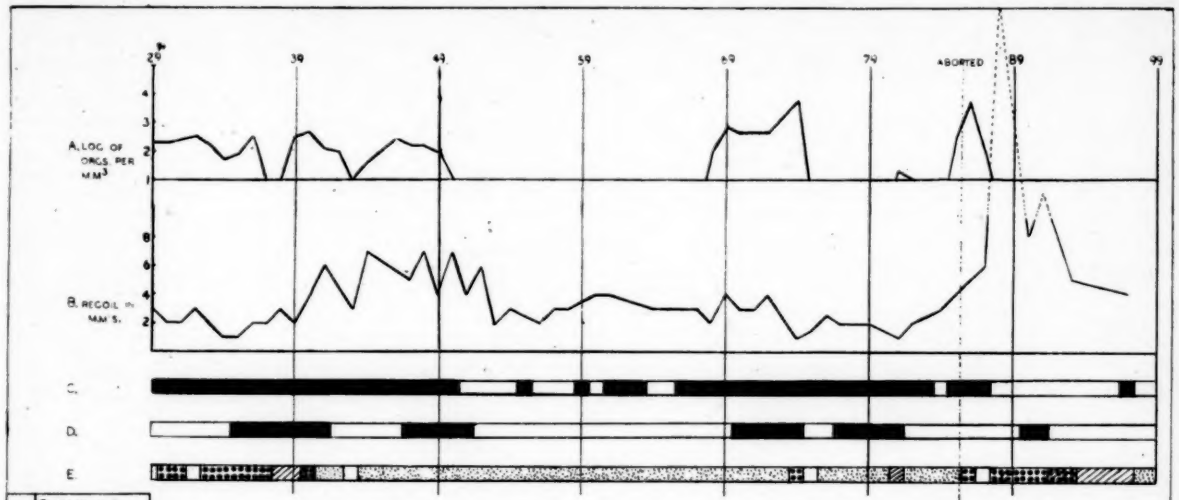

FIG. 1. A. Count of motile organisms per mm. by microscopical examination. B. Oestroscope readings. C. Days on which trichomonads observed. D. Days on which granular lesions observed on vaginal mucosa. E. Macroscopic appearance of discharge.

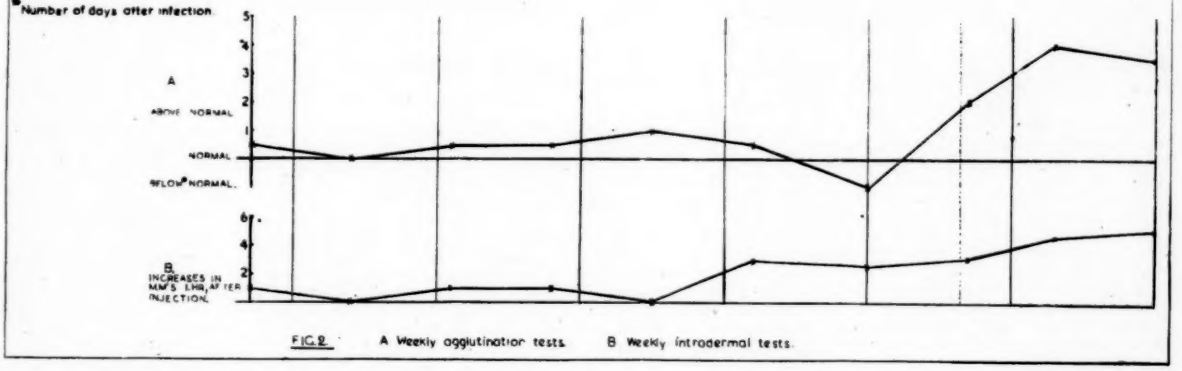

FIG. 2. A. Weekly agglutination tests. B. Weekly intradermal tests.

reduced motility continued up to the 67th day after which the majority of the organisms again became very active, and their numbers rose.

During the phases of reduced motility the organisms exhibited a smooth gliding movement and appeared to rely almost entirely on the undulating membrane as a means of progression. An increase in activity was observed to coincide with vigorous movements of the anterior flagella which appear to be responsible for the jerky manner of progression that is characteristic of *Trichomonas foetus*. This variation in motility appears to depend largely upon the viscosity of the mucus.

Organisms showing an unusual morphology, probably degenerate forms, were observed in the discharges, but not until the 66th day, and were thereafter found in the greatest numbers at the beginning and towards the end of the periods of increase, as for example from the 66th to 75th, the 80th to 83rd and 84th to 87th day. These organisms presented a rounded outline, and a movement of the undulating membrane that was often so slight as only to be discerned after most careful examination.

Incubation of material containing these aberrant forms, at 37° C. for half to one hour, resulted in an increase in their activity, and counts made before and after such incubation revealed that there had been, in some cases, an increase up to 100 per cent. of the active organisms. Counts made before and after incubation on the 71st day showed a rise from 450 to 1,040 active organisms per c.mm., and on the 72nd day from 530 to 980 per c.mm.

On two occasions, the 75th and 78th days, no organisms could be found by direct examination of the discharge nor after one hour's incubation at 37° C. Further incubation of the discharge overnight, however, with an equal volume of a mixture of equal parts of glucose saline and glucose heart broth, resulted in the demonstration of active trichomonads despite gross bacterial contamination.

II. Nature of Discharge

Macroscopically the discharge could be divided into two main types, one a scanty thick mucoid type, homogeneous and cloudy, often difficult to collect; and the other a thin clear mucoid matrix supporting discrete flakes of pus. The latter type was usually more copious and appeared to originate at the *cervix uteri*, and perhaps the uterus itself as it had been observed to discharge through the os at the time of sampling. If this supposition with regard to its origin is correct the increase in the count of trichomonads appears to be explained. The greater motility that is also observed is doubtless associated with the fluidity of the medium. See A, E on Fig. 1.

On making a vaginal examination seven hours before the occurrence of abortion a quantity of cloudy yellow mucoid fluid amounting to about two fluid ounces was seen to be lying in the vagina, and a further discharge of some six fluid ounces was observed to take place through the *cervix* at the time of examination. Bacteriological examination showed this discharge to be sterile, and as the foetal membranes were found to be intact when abortion occurred it is thought that the discharge must have originated from between the foetal and maternal placentae.

Granular lesions recurred at intervals during the course of the infection and were situated on the floor of the vagina in the anterior half of its length, and it was considered that there may have been some association between these lesions and the presence of organisms, as indicated in Fig. 1, A, C, D.

Fig. 2, A, B shows the responses that were obtained to the agglutination and intradermal tests for trichomoniasis. A definite reaction to the intradermal test was first observed on the 71st day while the level of agglutination only rose to a borderline positive after abortion had actually occurred.

Summary

The clinical observations made on this animal draw attention to the following points of importance in the diagnosis of trichomoniasis.

(*a*) The rapid appearance and disappearance of organisms over very short periods of time emphasises the importance of repeating the examination of discharges from suspected animals.

(*b*) The desirability of examining discharges from pregnant animals known to have been served by the suspected bull.

(*c*) The rounded form and sluggish movements of the organism at certain times shows the importance of making careful observations of the individual cells under the 1/6 inch objective.

(*d*) The occasional advantage that may be derived from the incubation of mucus samples prior to examination.

(*e*) The relative periods for the development of positive reactions to the intradermal test and agglutination test. Although an isolated example of this kind is of little value in assessing the usefulness of these tests, the data are given to complete the account of the clinical observations.

Acknowledgment.—I am greatly indebted to Dr. E. L. Taylor for his encouragement and for his assistance in the preparation of this paper for publication.

ABSTRACTS

[The Value of Local Injections of Penicillin Sodium in the Treatment of Streptococcus agalactiae **Infection and Mastitis in Cows.** Murphy, J. M., and Pfau, K. O. (1945.) *Cornell Vet.* **35**. 88-103.]

The authors have treated 52 infected quarters in 19 cows, by the injection of penicillin sodium *via* the teat canal. The bacteriological status of each quarter was determined by the plating of 1 ml. of a 1:20 dilution of milk in bovine blood agar, at 30 to 60 day intervals before treatment, on the day of treatment and daily while treatment continued, and weekly for four weeks after treatment ceased.

Three levels of dosage were tested: (1) Single doses of 5,000 to 200,000 units of penicillin; (2) 10,000 units five times at successive milkings; (3) 20,000 units five times at successive milkings.

In experiment (1) only five out of 15 quarters were freed of infection. Seven of the remaining quarters were retreated with single doses varying from 31,000 to 35,000 units. None were cured. In experiment (2) six out of ten quarters were freed of infection. Five of these quarters were clinically abnormal and improved rapidly with treatment. The four quarters not cured were free of infection for seven days after treatment. In experiment (3) 32 out of 32 quarters were freed of infection. Many of these quarters were showing considerable udder damage, but with treatment macroscopic improvement was immediate. Five of these quarters were failures in experiment (2).

Penicillin sodium was only slightly toxic. There was a rise in the milk leucocyte count during the first stage of treatment. There was no direct sign of tissue damage and there was no adverse effect on the milk yield. This was irrespective of the stage of lactation, previous duration of infection or the extent of udder damage.

D. L. H.

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[Acute Fatal Dilatation of the Stomach in the Dog (Torsion of the Stomach). Blackburn, P. S., and McFarlane, D. (1944.) *J. comp. Path.* **54**. 189-199.]

The authors give a detailed description of five cases of torsion of the oesophagus with rotation and dilatation of the stomach. The condition is said to cause serious losses among bloodhounds: two of the cases were in this breed, two were Great Danes and the other was a Red Setter. In four of the animals the stomach was rotated clockwise 270 degrees about the oesophagus. In the fifth case there was anti-clockwise torsion of 90 degrees. In the first group the pyloric part of the stomach passes *ventrally* from right to left and both pyloric and oesophageal orifices are sealed, the former by compression between the liver, oesophagus and the distended stomach and the latter by a twist of 270 degrees. In anti-clockwise torsion the pyloric part of the stomach passes *dorsally* from right to left. The oesophagus is less effectively sealed by the 90 degrees twist and the duodenum is merely kinked. This type of torsion thus results in less effective sealing of the stomach and it is conceivable that spontaneous recovery might occur. For the more complete sealing caused by clockwise torsion relief might be afforded by manipulation at exploratory laparotomy performed after trocar puncture.

Symptoms occur suddenly just after a meal. There is rapid abdominal swelling and great pain and the animal may try to vomit. With increasing abdominal distension severe dyspnoea occurs and if the condition is not relieved the animal dies within a few hours or may survive as long as 36 hours. Torsion can be diagnosed only by exploratory laparotomy as it is impossible to differentiate clinically between acute primary gastric distension and distension associated with torsion of the oesophagus.

Experiments on opened and unopened cadavers showed that inflation of the stomach, the animal being in the standing position, caused the second type of torsion—90 degrees anti-clockwise twist of the stomach about the oesophagus. It, however, the organs of the cadaver are arranged so that the spleen lies on the right aspect of the stomach and the splenic vessels lie on its right surface, inflation of the stomach causes the spleen to be dragged through a complete circle, finally resting in approximately its normal position and the stomach having performed a clockwise rotation of 270 degrees. Thus both types of naturally occurring torsion were produced in the cadaver, the type depending on the position of the spleen at the moment of distension of the stomach with air.

The theory that gastric torsion is due to a pendulum-like movement of the stomach brought about by a sudden jump or rolling is considered unlikely. It is difficult to believe that the dog's stomach possesses this degree of mobility. Torsion having occurred, it has been supposed that dilatation by gas rapidly occurs. It is rare, however, to find the stomach of the dog distended with gas at autopsy and this suggests that gas-forming organisms are not normally present in large numbers. The authors put forward the view that acute fatal dilatation is precipitated by a meal, often excessively large, which overwhelms a digestive system already weakened (improper feeding during war-time). The gastric contents are abnormal and the sphincters are atonic, and the combination of factors causes acute gastric dilatation which in turn gives rise to torsion, the direction of rotation depending on the position of the spleen at the moment of torsion.

E. G. W.

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[The Role of Animal-type Dermatophytes in Human Ringworm. Thomas, B. A., Lennox, M., and Duncan, J. T. (1945.) *Brit. Med. J.* September 15th. 346.]

There is evidence that ringworm infection in human beings is increasing at the present time, particularly ringworm of the scalp. It is the belief of the authors that transmission from animals to man occurs far more commonly than is supposed. Generally speaking, little has been done by cultural tests to determine the types of ringworm fungi in Great Britain. A recent investigation (1928) of cases in L.C.C. schoolchildren showed that *Microsporum audouini* (human type) predominated. More recently, an examination of 265 unselected cases in the southern counties of England and Wales resulted in 211 isolations of *Microsporum* of which 122 (58 per cent.) were animal types (*M. lanosum* 74, *M. felineum* 48). Thus it would appear that the dog and cat play a considerable part in the transmission of ringworm to human beings. Transmission from calves (*Trichophytum* species) occurs sporadically in rural areas, but is uncommon in urban districts and is not a problem as a source of institutional outbreaks.

The authors describe an "epidemic" in which an adult and four children, directly, and four children and a cat, indirectly, were infected from a puppy. The puppy was a mongrel of uncertain age and origin and was in a "mangy" condition when bought. When examined there was gross involvement of its skin, the trunk being almost devoid of hair and the limbs and head only sparsely covered. The causative organism in all cases was found to be *M. lanosum*.

A further series of 45 unselected cases of human ringworm yielded 21 positive cultures. Sixteen cultures were of animal type (*M. felineum* 5, *Trichophytum asteroides* 10, and *T. discoides* 1). In the bulk of cases, however, direct evidence of animal contagion was not confirmed, as opportunities of examining the animal suspected did not often present themselves. It was noted that in contrast to the ease with which human types are transmitted from man to man and animal types from animal to animal, there is a smaller risk of contagion from animal to man and from man to animal. Similarly the animal types do not tend to spread from man to man. Thus in the "epidemic" referred to above four of the primary cases were all grossly affected, whereas the four secondary cases showed only solitary lesions. No tertiary cases were encountered.

Clinically it is often possible to distinguish between human- and animal-type infections in human beings. Generally the animal types give rise to lesions of an inflammatory appearance sometimes with definite pustular formation or even being grossly suppurative (kerion). Animal-type infections are curable by conservative treatment (6 per cent. precipitated sulphur and 4 per cent. salicylic acid ointment), whereas in human type infections, epilation with X-rays holds pride of place.

J. S. P.

Questions and Answers

"Questions and Answers" will be published on alternate weeks.

The submission of questions for inclusion in this column will be welcomed: they can relate to any aspect of veterinary work. For purposes of record, each question is numbered, and those submitting questions are required to furnish (not for publication) name and address.

Answers to readers' queries represent exclusively the personal opinions of the writers, and criticism of the replies will be appreciated.

All communications should be addressed to the Editor.

Incomplete Service (Bull)

Q. CXXXIV.—*A yearling bull in good condition and apparently normal, when put to service will mount readily and frequently, but does not complete the act and there is no ejaculation.*

What treatment should be applied and is it likely to result in a reasonable degree of fertility?

A.—It is not quite clear, from the question, whether the bull manages to "draw," *i.e.*, protrude, the erected penis (and, if so, to the normal full extent) or not.

The type of cases most commonly met with are where the penis does not appear or protrudes only for three or four inches. This is generally due to simple immaturity and time is the usual curative factor. It is generally of advantage to allow such a bull to run with a bunch of heifers for two or three months. The normal love-play of oestrum then takes place under natural surroundings and the young bull gradually learns what is expected of him.

Development is also helped by good feeding, housing and exercise, and may be accelerated by the use of gonadotrophic hormones, and possibly vitamin preparations (vit. A, C and E have all been used). When there is incomplete erection of the penis, lutealising hormone or testosterone might be used.

There are, of course, some cases which are due to structural abnormalities.

(*a*) Smallness of the opening of the sheath.
(*b*) Pot-belliedness of bull, preventing penis entering cow's vagina.
(*c*) Shortness of penis.
(*d*) Undue power of retractor penis muscle.
(*e*) Adhesions between penis and prepuce.
(*f*) Enlarged prostate.

(*a*), (*d*) and (*e*) may be treated surgically; (*f*) may respond to a course of stilboestrol.

A third group of causes are those which produce pain when erection occurs, *i.e.*, wounds, or granuloma of penis, or even "gravel" around the preputial opening.

If the penis is normally developed and protrudes normally into the cow's vagina, but ejaculation does not take place, once again immaturity suggests itself as the most likely cause. A dose of pregnant mare's serum (3000 I.U.), intramuscularly, will often give good results in such cases. Time and experience are again the most useful factors in improving the circumstances.

. . . . . .

Parasitic Infestation

Q. CXXXVI.—*In the course of my reading recently, I came across the following statement: "The acquisition of (parasitic) infection varies as the square of the animal population."*

I am not mathematics-minded. Can you simplify and clarify this statement, giving an example of how it operates?

A.—The mathematical presentation of such a numerical relationship as that of host and parasite must not be taken too literally, and, in this instance only as a ready means of expressing the sort of thing that happens to the parasitic infestation when the number of grazing stock per unit area is increased. The easiest explanation seems to be by means of an example, a hypothetical situation, say, in which one fowl, carrying a unit infestation of a certain parasite, is enclosed on a unit area of ground, all so nicely balanced that the fowl passes ten worm's eggs per day and picks up ten worm's eggs per day. Suppose, then, that a second fowl is introduced, carrying the same unit of infestation, so that 20 eggs per day are passed on to the same unit area, then the worm's eggs will lie twice as thickly on the ground and each fowl will pick up 20 eggs per day, making a total pick up of 40 eggs, and leading to the return of 40 other eggs to the unit area of ground. Similarly, if ten fowls carrying the same unit infestation were placed on the unit area, a time would soon come when each would pick up 100 eggs and the total pick up, and, later, the return to the surface of the pen would be 1,000 eggs.

It is obvious, of course, that many other factors are involved and that these hypothetical figures are very far removed from what actually occurs; nevertheless, the increase of helminthic infection with the increase of stock per unit area can very well be expressed as a tendency for the parasites to increase as the square of the host population per unit area.

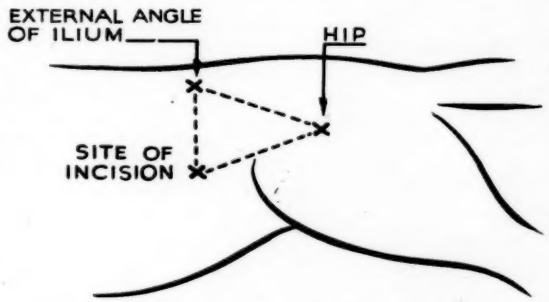
Spaying of the Female Cat

Q. CXXXV.—*Granted that the anatomy is known, would you please advise me upon the operation of the neutering of female cats; also if nembutal is still the best general anaesthetic to use in these cases?*

A.—The best time at which to perform the operation is three to four months, although it may be carried out at any age with excellent results.

The modern technique involves a flank incision although the mid-line operation still has some advocates. A description of flank technique is appended, accuracy in site of incision being essential. Readers may also be referred to the lucid description of the flank operation of ovaro-hysterectomy in the kitten given, with excellent illustrations, by J. G. Wright, on pages 1372 and 1373 of the issue of *The Veterinary Record* of December 23rd, 1933 (Vol. **13**, No. 51).

The cat is hobbled down on its right side, with limbs fully extended. The site of incision is then *immediately below the external angle of the ilium*, from ½ in. to 1 in. below this prominence according to the size of the cat. A useful method of determining the site in cats of any size is to regard the prominence of the hip as the apex of an isosceles triangle, the external angle of ilium as one angle of the base and the remaining angle is then the site of incision.



At this point an incision, which need not exceed ½ in., is made obliquely downwards and backwards through skin and subcutaneous tissue; care will avoid the blood vessel usually traversing the subcutaneous tissue of this region. In cats in good condition a layer of fat is now encountered; removal of a piece of this fat with scissors will facilitate the muscle incisions. The underlying and fairly thin external oblique muscle is now picked up and incised by an upward "snick"; forceps are introduced through this incision and the next layer of muscle (which comprises the closely adherent internal oblique and transversalis) is picked up tent fashion and incised by a "stab"; this stab usually incises the peritoneum which is fairly closely applied to the transversalis; failure to incise the peritoneum at this stage may cause confusion.

With the edge of the internal muscle incision held by dressing forceps, another pair of dressing forceps is introduced in a slightly upward direction into the abdominal cavity (*i.e.*, towards the sublumbar muscles) when a pad of fat will be picked up. This is a layer of retro-peritoneal fat and is recognised by its smooth surface as distinct from the freely moveable and uneven omentum. The ovary and uterine horn is attached to the ventral surface of this fat so that by gradually pulling the lower surface of this fat upwards the ovary and/or uterine horn will be brought into the incision. One arm of the forceps is then pushed through the non-vascular broad ligament and the uterine horn prevented from slipping back.

The ovary is pulled through the incision and artery forceps clamped on ¼ in. to ½ in. below it (forci-pressure is sufficient in kittens, but ligation will be necessary in adult cats or kittens in oestrus). The ovary and uterine horn are severed immediately above the artery forceps and the horn is now retracted gently but firmly backwards, and level with the cat's body, which will bring into view the bifurcation of the uterine horns; the lower horn can thus be picked up and drawn into the incision and the ovarian end dealt with as described. The body of the uterus is severed by clamping as far back as possible with artery forceps and is twisted off by a second pair of artery forceps applied directly over the first pair. Again, ligation is necessary in adult cats. Artery forceps are now removed and the incision is closed by a single suture through each layer of muscle, or all. No. 0 or 1 silk is entirely satisfactory. The skin incision is closed by two interrupted silk or nylon sutures. Healing is almost invariably by first intention.

Anaesthesia.—In the writer's view oxygen bubbled through ether is the anaesthetic of choice for spaying, using Wright's apparatus. In the hands of a practised surgeon, even if no spectacular "speed" attempts are made, a kitten can be spayed in less than five minutes, whilst ten to 12 minutes suffices when ligating is required; it is

therefore unnecessary and undesirable to utilise an agent giving one to two hours' surgical anaesthesia and a recovery period of 16 to 24 hours. In addition, barbiturate anaesthetics cause some dilatation of blood vessels, hence haemorrhage is more likely if these are used. Pentothal sodium is short-acting but is expensive and, in common with nembutal, has the disadvantage that for safe and efficient anaesthesia it must be given by the intravenous route —not always an easy matter in young and lively kittens even for the experienced intravenous anaesthetist. The use of nembutal by the peritoneal route cannot be recommended, whilst chloroform is, of course, extremely toxic for young cats.

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Correspondence

Foul Mouth in Cocker Spaniels

Sir,—Although the treatment described in your answer may reduce the irritation and lessen the odour, I have found that the following simple operation effects a permanent cure. The saliva flows down the upper cannine into the groove on the lower lip in which the tip of the tooth rests. The constant flow of saliva irritates the skin and produces a localised necrosis.

The hair is clipped and a local anaesthetic injected. The floor of the groove is picked up with forceps just below the point where the tip of the canine tooth rests and excised with curved scissors. One suture of silkworm gut is inserted, thus closing the channel. The operation is repeated on the opposite side.

Yours faithfully,

45, St. James' Street, Nottingham. R. H. Smythe.

January 1st, 1946.

NOTES AND NEWS

The Editor will be glad to receive items of professional interest for inclusion in these columns.

Diary of Events

Jan. 18th.—Annual Meeting of the Mid-West Division, N.V.M.A., at Bristol (Bright's Restaurant, Queen's Road, Clifton), 2.15 p.m.

Jan. 25th.—Annual Meeting of the Yorkshire Division, N.V.M.A., at Leeds University, 2.30 p.m.

Jan. 25th.—Annual Meeting of the Royal Counties Division, N.V.M.A., at Reading (Caversham Bridge Hotel), 2.30 p.m.

Feb. 21st.—Meeting of the Southern Counties Division, N.V.M.A., at Bournemouth.

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Refresher Courses for Veterinary Surgeons Returning from the Forces

In view of the importance of the above matter, we reproduce the announcement made in our issue of December 1st, 1945, which was as follows:—

1. Arrangements have been made to provide refresher courses for veterinary surgeons returning to civil life after a year or more in the Forces or other war service. Awards under the Further Education and Training Scheme may be made in respect of these courses to applicants accepted as eligible by the Ministry of Labour and National Service. Awards may cover fees and maintenance (but not premiums to practitioners). Save in exceptional circumstances, a maintenance grant will not be paid for a period exceeding three months.

2. Applicants with more than *two* years' war service may express their preference for one of the following courses and as far as possible their choice will be observed:—

(*a*) A course of up to three months with an approved practitioner, including, if so desired, a week or ten days at the Ministry of Agriculture's Veterinary Laboratory, New Haw, Weybridge, Surrey, or at a veterinary college laboratory and/or a week or ten days at one of the Ministry's Divisional Offices.

(*b*) A one-term special course (about ten weeks) at a veterinary college.

3. Applicants with from one to two years' war service may apply for a four weeks' refresher course with an approved practitioner.

4. Accommodation and facilities at the veterinary colleges are limited, and it is not possible for the colleges to guarantee a place to all applicants. The one-term special courses are intended primarily for veterinary surgeons whose war service has kept them out of professional work for several years, and will ordinarily be available only for the Christmas (October to December) and the Summer (April to June) terms. The short courses at veterinary college laboratories will be given during vacation. Facilities at the Ministry's Veterinary Laboratory are also limited, but it is proposed to arrange two or three courses of a week or ten days for groups of about 20. Although the numbers that could be taken at a Divisional Office at any one time are limited, the veterinary surgeon could take that part of his course either before, or during, his training with a practitioner, and no difficulty is anticipated in providing training at a Divisional Office for all who desire it.

5. Applicants should communicate in the first instance with the National Veterinary Medical Association, 36, Gordon Square, London, W.C.1, stating the particular type of refresher course they desire (see paragraphs 2 and 3 above). The Association will then arrange such a course.

6. When arrangements for a refresher course have been made through the National Veterinary Medical Association, and the applicant desires an award under the Further Education and Training Scheme to enable him to take the course, he should apply to any local office of the Ministry of Labour and National Service. If the applicant appears to be eligible for grant, his application will be forwarded by that Department to the Ministry of Agriculture or the Department of Agriculture for Scotland as the case may be.

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Veterinary Premises in Residential Zones

We reproduce below the reply received by the Association to an enquiry, addressed to the Minister of Town and Country Planning, as to whether a veterinary surgeon would be permitted to start a practice in an area zoned as residential and, if so, whether there would be any conditions with which he must first comply.

Ministry of Town and Country Planning,
32, St. James's Square,
London, S.W.1.
November 27th, 1945.

Sir,

I am directed by the Minister of Town and Country Planning to refer to your letter of the 15th instant, and to say that, with a view to the avoidance of possible difficulties subsequently arising as a result of action by Local Planning Authorities, he is of opinion that whenever a member of the profession has in mind the erection or use of stabling or other buildings in connection with his practice in an area which the Authority propose in their Planning Scheme should be used for residential purposes, he should be advised in the first place to approach the Authority for their consent to his proposals.

Similarly, in an area where no Planning Scheme is in operation and where, therefore, there will probably be some doubt in the member's mind as to the present intentions of the Local Planning Authority with regard to the use of the particular area concerned, an approach to the Authority should always be made before any expense in the direction of erection, adaptation or purchase of premises is incurred.

As you are no doubt aware, under the present law there is a right of appeal to the Minister against a refusal of consent by the Authority or the imposition by them of conditions attached to a consent.

Should you wish to refer your members to the appropriate enactments, their attention may be drawn to the following:—

"Section 10 of the Town and Country Planning Act, 1932.
Section 5 of the Town and Country Planning (Interim Development) Act, 1943, and
The General Interim Development Order, 1945.
A new Order is due in the early part of 1946 but it is not likely to affect the position of the matter under consideration."

In any area where a Planning Scheme is in operation, the Scheme should be inspected at the offices of the local Council. Finally the bearing on the matter of any fresh planning legislation should, of course, not be overlooked.

I am, Sir,
Your obedient Servant,
(Signed) H. W. Fricker.

PERSONAL

Births.—Franklin.—On January 1st, 1946, at the Beeches Nursing Home, Wolverhampton, to Margaret (née Bryce), wife of Douglas Franklin, M.S.R.C.V.S.—a son (Richard Michael).

Harries.—On December 28th, 1945, to Nance Mary (née Twiddy), wife of D. C. Harries, M.R.C.V.S., Fakenham, Norfolk—a daughter (Ann Denise).

Smith.—On January 4th, 1946, at Cresswell, Dumfries, to Margaret (*née* Campbell), wife of R. J. Smith, M.R.C.V.S.—a son.

Marriage.—Wood—Downs.—At Aust, near Bristol, on December 31st, 1945, Douglas Roy Wood, M.R.C.V.S., son of Mr. and Mrs. G. S. Wood, Aust, Bristol, to Barbara Downs, S.R.N., S.C.M., daughter of Mr. and Mrs. S. Downs, of Dinnington, Sheffield.

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R.C.V.S. OBITUARY

O'Donel, Sidney, M.C., Lt.-Col., R.A.V.C. Graduated Dublin, July 16th, 1914. Died at Rangoon, December 25th, 1945.

Wilson, William Leveney, Inspector, Animal Health Division, Ministry of Agriculture and Fisheries, Northampton. Graduated Edinburgh, July 16th, 1932. Died January 2nd, 1946.

Mr. William L. Wilson, M.R.C.V.S

The death of William Leveney Wilson at the early age of 35 years came as a shock to his colleagues on the Animal Health Division, and to his many friends in the Northamptonshire district, where he has been stationed for the past five years. Although he had not been well for a few weeks, it was only recently that his condition took a serious turn necessitating his removal to hospital at Oxford, where he died shortly after admission.

Graduating at Edinburgh in 1932, Mr. Wilson joined the staff of the Leicestershire County Council in 1935, transferring to the Animal Health Division on its formation. After a period at the Laboratory at Weybridge, he returned to the field at Northampton where he soon became popular with his professional colleagues, and local agriculturalists.

He is survived by his widow and two young children to whom we extend much sympathy in their great loss.

The funeral took place at Milton, Northampton, on January 5th, and was attended by the following members of the profession: Messrs. W. L. Sheffield and D. D. Canning (representing the Ministry of Agriculture and Fisheries), Mr. S. V. Collard (representing the Association of Veterinary Inspectors), Messrs. O. Durrant and W. Nightingale (Oxford), J. M. Fraser (Oxford), J. G. Crowhurst (Leicester), Major J. A. Dunlop and Mr. G. S. Sutton (Northampton), and Mr. E. W. Hudson (Kettering).

The Late Major William Squire Stevens, M.R.C.V.S.

Major William Squire Stevens, whose sudden death on Christmas Day was recorded with much regret in our last issue, was the son of the late Henry W. Stevens, M.R.C.V.S., of 9, Park Lane, W.1.

After qualifying in Edinburgh in 1901, he received his commission in the R.A.V.C. and served in S. Africa and in the Repatriation Department there. In August, 1914, he was posted to the Remount Depot, Aldershot, proceeding to France in March, 1915, and later to Italy. On returning to England in 1918, he was posted to the Remount Depot at Swaythling.

On demobilisation Major Stevens went into practice at Wincanton, Somerset, where he was veterinary officer to the North Somerset Yeomanry. He hunted with the Blackmore Vale and was a member of the Sherborne Polo Club.

He was forced to retire from general practice in 1927 owing to ill-health contracted in the war of 1914-1918.

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ADDRESSES OF DISEASE-INFECTED PREMISES

Foot-and-Mouth Disease:

Cornwall.—The Barracks, Bodmin, Cornwall (Jan. 7th).

Herts.—Bygrave Manor Farm, Bygrave, Baldock, Herts (Jan. 5th).

Swine Fever:

Beds.—Top Farm, Ravensden, Bedford, Beds. (Jan. 3rd).

Carms.—Felyn Newydd, Porthyrhyd, Carmarthen (Jan. 2nd); Penyplas, Tanygraig, Felinfoil, Llanelly, Carms. (Jan. 3rd).

Glos.—Meadow Cottage, Mill Hill, Bream, Lydney, Glos. (Jan. 1st).

Lincs. (Kesteven).—Club Yard, Blacksmith Lane, Harmston, Lincoln (Jan. 6th).)

Somerset.—Physic Well Farm, Stoke Trister, Wincanton, Yeovil, Somerset (Jan. 7th).

Surrey.—Brickfield Farm, Limpsfield Road, Warlingham, Surrey (Jan. 1st).

Sheep Scab:

Montgomery.—Bronallt Farm, Llanthaiadr Y.M., Oswestry, Shropshire (Jan. 3rd).

Yorks (W.R.).—Hornbeam Farm, Hookstone Road, Harrogate, Yorks (Jan. 1st).

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CIVIL SERVICE WAR BONUS: CONSOLIDATION WITH BASIC PAY

The Treasury announces the conclusion of agreements under which the war bonus payable to non-industrial Civil Servants is consolidated with basic pay. The present system of pay plus bonus is replaced, with effect from November 1st last, by payment of inclusive amounts represented by the sum of basic pay plus "consolidation additions."

In fixing these additions account has been taken of movements which have occurred in the general level of remuneration outside the Civil Service since the bonus was last revised in 1944. New consolidated scales of pay based on the new inclusive payments will be drawn up and put into effect as soon as possible.

The agreements provide for the following changes as they affect salaried staff:—

Before November 1st, 1945, war bonus was payable to all adult salaried staff with basic salaries not exceeding £1,500 per annum at the rates of £60 per annum for men and £48 per annum for women. Subject to special arrangements to avoid anomalies at those points in the basic salary scales where the rates of addition change, the consolidation additions for adults will be as follows:—

Men.		*Women.*	
Basic salary.	*Addition.*	*Basic salary*	*Addition.*
Below £400	£78	Below £320	£63
£400–£849	£90	£320–£679	£72
£850–£1,099	£105	£680–£924	£84
£1,100–£1,500	£120	£925–£1,325	£96

The additions fall on a sliding scale above £1,500 (men) and £1,325 (women) and cease altogether at £1,700 (men) and £1,550 approximately (women).

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BIOLOGICAL WARFARE RESEARCH

Valuable Knowledge Acquired by Scientists

Intense research work on biological warfare was carried out in this country during the war by a team of highly qualified scientists. An official announcement by the office of the Minister of Defence which makes this disclosure states that from 1942, Britain, the United States, and Canada worked together to devise countermeasures, for it was known that Germany was studying biological warfare.

The research in this country has resulted in the accumulation of much knowledge concerning fundamental problems in microbiology, including new techniques applicable to the study of preventive medicine and of value to agriculture. The Government intend to make the results of fundamental studies available to scientific workers generally, and arrangements for publication by the learned societies and in appropriate scientific journals are now in progress.

Biological warfare was discussed at the Geneva conference of 1925, and a protocol prohibiting the use of bacteria in warfare was ratified by various countries, including Great Britain and Germany. Before the war it came to the knowledge of Great Britain that Germany was conducting experiments in this form of warfare, and an organisation was set up under the Committee of Imperial Defence to consider the available intelligence and countermeasures.

After the fall of France it was decided that experiments should be carried out to assess with greater accuracy the possible effects of German secret weapons of this nature and to design defences. Intense research work was therefore carried out in this country by a team of highly qualified scientists.

Results of Research

These were some of the more important accomplishments:—

Development of methods and facilities for the mass production of micro-organisms and their products.

Development of methods for the rapid and accurate detection of minute quantities of disease-producing agents.

Significant contributions to knowledge of the control of airborne disease-producing agents.

Production and isolation for the first time of a crystalline bacterial toxin which has opened the way for the preparation of a more highly purified immunising toxoid.

Development and production of an effective toxoid in sufficient quantities to protect large-scale operations should this be necessary.

Significant contributions to knowledge concerning the development of immunity in human beings and animals against certain infectious diseases.

Important advances in the treatment of certain infectious diseases of human beings and animals and in the development of effective protective clothing and equipment.

Developments of laboratory animal propagation and maintenance facilities to supply the tremendous number of approved strains of experimental animals required for investigations.

Applications of special photographic techniques to the study of airborne micro-organisms and the safety of laboratory procedures.

Information on the effects of more than 1,000 different chemical agents on living plants.

Studies of the production and control of certain diseases of plants.

DAIRY FARMING IN INDIA

Mr. R. A. Fepperall, Chief Regional Officer of the Milk Marketing Board, who recently compiled a report on the dairy industry for the Government of India, said last evening (says *The Times* of January 8th) that he thought the Hindu people are faced with the alternative of ultimate famine for themselves or a reduction to reasonable numbers of the cattle population. Addressing the Growmore Club and National Farmers' Union at Fareham, he pointed out that while India possessed not fewer than 219,000,000 milking cattle—one-third of the world's total—one person in six of her vast population got no milk, and the remaining five received an article usually highly contaminated. Analyses had shown that London's sewage was three times as safe as Bombay's milk.

The feeding of this livestock in a country with tremendous areas of arid land was a very serious problem. One reason for the decline in the dairy industry under British administration had been the practice of exporting from India large quantities of cotton seeds, linseed, ground nuts, and other commodities. All of them ultimately found their way into the artificial cattle foods upon which the British dairy farmer depended in pre-war days for the maintenance of his milk supplies, but these exports had starved India's own stock and deprived her soil of its fertility.

To-day, for the first time, India was a creditor nation. More than a hundred thousand million pounds were due to her as a result of the war, and the effect of this on British dairy farming is likely to be important. India would be less willing to export her oil seeds oversea and, in fact a complete embargo on all such exports should be introduced in order that they may be available to feed her own stock. This would inevitably reduce the quantity available on the world market, and so increase the price of artificial foods.

* * * * *

Weekly Wisdom

"*. . . While it is admitted that the science faculties of our universities are in need of a much greater measure of support, the reason generally given for supporting them is that they are the training ground for future technicians. Yet the universities are places where it should be possible for chosen men—carefully chosen men—to have the leisure and conditions necessary if they are to pursue with freedom that sublime curiosity into Nature's workings which prompted* Newton *and* Faraday *and to inspire the young with some other ideal than bigger and better refrigerators. Both* Newton *and* Faraday, *it is true, devoted part of their time to practical problems, but the glory of British science in the eyes of the world—and reputation has a material value—would be no less if* Newton *had not improved our coinage nor* Faraday *worked on steel. . . .*"—*The Times*, December 10th, 1945.

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The England Rugby team to meet Wales at Cardiff on January 19th will be the same as that chosen for the game with Scotland arranged for January 5th, but which was postponed. Accordingly, Michael R. Steele-Bodger will be playing alongside his Cambridge University captain, E. Bole, in the English pack.

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The Minister of Agriculture and Fisheries has appointed Mr. A. C. Sparks to be his Private Secretary as from January 1st, 1946.

CORRESPONDENCE

The views expressed in letters addressed to the Editor represent the personal views of the writer only and must not be taken as expressing the opinion or having received the approval of the N.V.M.A.

Letters to the Editor should reach the Office not later than by the first post on Monday morning for insertion in following Saturday's issue.

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REFRESHER SCHEME FOR MEMBERS FROM THE SERVICES

Sir,—It was with considerable surprise that I received a notice from the Society of Veterinary Practitioners stating that an insufficient number of veterinary surgeons had offered to assist in the Refresher Scheme for members coming out of the Services.

This matter is urgent and I ask practitioners to send a note at once to the N.V.M.A. stating their willingness to participate in the Scheme. I know that practitioners have been much overworked during the past six years, but that is no excuse for avoiding their responsibilities or their duty.

Yours faithfully,

Berkeley Lodge, F. Beckett.
Blandford, Dorset.
December 31st, 1945.

[The early release of members of the profession who are serving with the Forces necessitates the provision of adequate facilities for refresher courses. We would therefore urge all practitioners who can participate in this scheme to send their names without delay to the General Secretary, N.V.M.A. There is a danger that if a sufficiently large Panel is not available the release of these members from the Forces may be delayed.—*Editor.*]

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THE PROFESSION AND THE NATIONAL MILK IMPROVEMENT SCHEME

Sir,—After having read the Centenary Commemoration Number of *The Veterinary Record*, full of the past achievements of our profession, it was with great disappointment that we noted the account of the meeting between the deputation of the N.V.M.A. and the Permanent Secretary of the Ministry of Agriculture on the Ministry's proposals for implementing the White Paper on "Measures to Improve the Quality of the Nation's Milk Supply." Surely anyone with the most elementary knowledge of our profession must realise that this a scheme which must be administered by veterinarians if it is to function at all efficiently. That we should work as a mere arm of the service in parallel with several others, all probably being co-ordinated by bureaucrats, is to our mind quite unthinkable.

The Secretary speaks of the importance of the National Milk Testing Scheme and the Milk Marketing Board. While, undoubtedly, the dairy bacteriologist is quite capable of carrying out routine tests on milk, it is only the veterinary surgeon who is suitably qualified to realise the true significance of the position, co-ordinate the facts and advise on the problem of milk production. Again, while agreeing that the Milk Marketing Board is a fit body to deal with the retailing of milk, we feel that its functions should end here.

To say that these problems are too wide in scope and too complex to be embraced entirely by the Animal Health Division of the Ministry and to come under the sole supervision of the veterinary staff is a slight upon our colleagues in that service and should not go unchallenged as we cannot envisage a better body of persons to control this scheme. It would be interesting to know who else could be considered adequately qualified to control the new Division of Livestock Improvement and Dairy Husbandry that has been set up.

The President of the N.V.M.A. and his deputation are to be congratulated upon taking up this matter but the fact that we had not been consulted about this change of conception by the Ministry of the White Paper does not increase one's confidence in the assurances given that the N.V.M.A. will be consulted throughout with regard to any future arrangements. Recently we have had ample evidence of so many other activities which are passing into non-veterinarian control, such as animal breeding, genetics and artificial insemination. It is obvious that, unless a firm stand is made now, the future of our profession is going to be extremely cramped and limited.

Yours faithfully,

K. M. Smith.
H. Williams Smith.

Riverside,
Tonbridge, Kent.
January 1st, 1946.

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VETERINARY SERVICES EMOLUMENTS IN NEW ZEALAND

Sir,—The article on the Veterinary Services in New Zealand published in the Centenary Commemoration Number on December 22nd, 1945, includes a reference to emoluments. These have recently undergone revision and I should be glad therefore if you will allow me to state that the scale of salaries now offered by the Federation of Farmers' Veterinary Services is as follows:—

First year	...	...	£550
Second year	...	...	£600
Third year	...	...	£700
Fourth year	...	...	£800

In addition to above, a "cost-of-living" allowance of £13 per annum operates on salaries up to £765. A salary of over £800 is paid in connection with a few senior posts. If a car is not provided by the club, motor allowance is granted. Provision of drugs is arranged by the club. £10 per annum is allowed for the upkeep of instruments. In making appointments, the Federation takes into consideration the applicant's length of graduation and experience in relation to commencing salary.

With regard to veterinarians' salaries in the Government Service the scale is £535, £590, £640, £690. District Superintendents receive £740-£790. The cost-of-living bonus (£13) mentioned above operates similarly. In these appointments the minimum, £535, would be given to recent graduates, and higher commencing salaries offered to applicants some years qualified and with good experience.

Yours faithfully,

New Zealand Government Offices, H. A. Reid.
415, Strand, London, W.C.2.
January 7th, 1946.